Ohio Agricultural Experiment Station

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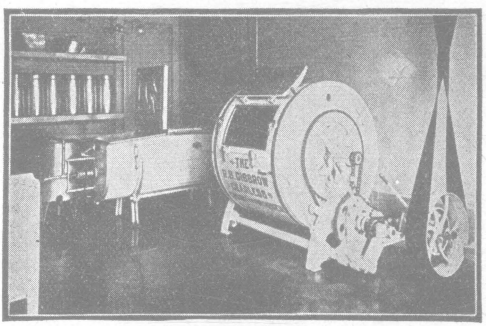
THE CARE OF CREAM



Care determines the quality
Quality makes the market

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THE CARE OF CREAM

SUGGESTIONS FOR OHIO CREAMERY PATRONS

By A. E. PERKINS

QUALITY OF BUTTER

Butter has been from prehistoric times one of the most highly prized of human foods. Not primarily on account of the high food value it possesses, but on account of the fine flavor (taste and odor) it imparts to other foods when cooked with or spread upon them.

Flavor then should be the consideration of first importance in the selection and grading of butter; that this is actually the case can readily be seen by a glance at the accompanying score card, which is in common use by butter judges in large markets. Nearly as much importance is attached to this one property—flavor—as to all other properties combined. With farm-made butter, mechanical defects due to a lack of suitable control over the conditions under which the butter is manufactured, exert nearly as great an influence as flavor in determining the grade and selling price of the butter; but given a well equipped creamery and a competent butter-maker, there is usually very little difficulty in producing butter which will score nearly perfect in all properties except flavor. As applied to the product of an up-to-date creamery, then, the term "good butter" means butter having an agreeable flavor. Such butter can be made only from good cream.

BUTTER SCORE CARD

Flavor.....45 percent
1. Curdy flavor (Sour cottage cheese smell and taste)
2. High acid flavors (Excessive sour smell and taste)
3. Lacking flavor (Lacking taste and smell)
4. Rancid or old cream flavors
5. Oily or greasy flavors (Oily and greasy taste and smell)
6. Fishy flavors (Bad taste and fishy smell)
7. Stable flavors (Bad taste and cow stable smell)
8. Bitter flavors (Bitter taste)
9. Weedy and food flavors
10. Unclean flavors (Unclean smell and taste)

Body or texture.....25 percent
1. Weak body (Soft and weak)
2. Greasy body (No grain, dead in appearance)
3. Body showing too much moisture
4. Milky brine

Color.....15 percent
1. Mottled appearance
2. Color specks (Specks appearing throughout butter)

Saltings.....10 percent
1. Too coarse, gritty
2. Unevenly distributed
3. Too low or too high salt content

Package.....5 percent
1. Bad appearing, dilapidated package
2. Badly trimmed and dirty on top or sides
3. Butter not packed solid

Total.....100 percent

(Wisconsin Experiment Station Bul. 102.)

Milk secreted by a healthy cow will nearly always, when properly milked and handled, yield good cream; that is, cream possessing a sweet and agreeable taste and odor. If through carelessness or lack of understanding of the requirements, the milk and cream are not produced and cared for properly, the cream will usually acquire bad flavors which can never be removed and which go directly into the butter, causing it to receive a low grade in the market. The fact that the butter is made at a creamery rather than at home does not release the farmer from responsibility regarding its quality; for the butter maker at the creamery is as powerless to make good flavored butter from poor flavored cream as the farmer himself would be. Instead of being responsible for the quality of the small amount of butter made from his own cream, he is in a large measure responsible for the quality of the entire churning of butter into which his cream has entered. Quality determines the price at which the creamery is able to sell its product, and consequently the price it is able to pay its patrons for butterfat. Prudence then joins with community and family pride in urging the farmer not to allow his carelessness and indifference to lower the quality of the butter produced at the creamery buying his cream.

Good butter is always in demand at the highest prices, while poor flavored butter can be sold only with difficulty at any satisfactory price, because most consumers are willing to pay a liberal price for a good, dependable product, but are not willing to take an inferior article at any price. Little exact information is available, but those familiar with the conditions assert that probably not more than half of the butter offered for sale on the large markets can be classed as good table butter. The good butter always finds a ready market. A large part of the poor butter is ordinarily bought up at low prices, melted and worked over into what is known as "renovated" or "process" butter. The less objectionable portion of this poor butter is sold directly at a sacrifice of several cents per pound below the price commanded by the best grades. At times when butter is scarce much of this poor butter is "worked off" on the markets at fancy prices. Consumers who would gladly pay any reasonable price for good butter are driven to the use of margarine and other butter substitutes because of the poor quality of the only butter obtainable. The fact that practically all of this poor butter is the result of poor methods in producing and handling the cream from which it is made and that it might with proper care have been as good as the best butter should cause the farmer to think seriously about his methods and the possibility of improving them.

CAUSES OF BAD FLAVORED BUTTER

Bad flavors may be caused by materials consumed as food, such as onions, cabbage, turnips, ragweeds, and spoiled feeds; or by the cream absorbing odors of stables, cellars, kitchens, etc.; but by far the greatest source of bad flavors is the growth in the milk, cream or butter, of bacteria, yeasts and molds. Milk in the cow's udder is practically free from bacteria, but millions of them or their spores (seeds) are introduced into the milk by dust settling from the stable air, by hair, by small particles of manure falling into the milk pail from the cow, and by dirt from the hands and clothing of the milker. Many more are introduced by poorly constructed and carelessly washed milk utensils. Milk is an ideal food for these organisms, and at favorable temperatures (70° to 100° Fahr.) they may increase in number several million times in 24 hours. At temperatures below 50° F. their growth is very slow; hence, the best and only practical way to avoid damaging the cream with these organisms is to keep them out of it by keeping everything as clean as possible, and by keeping the cream cool so that the few which do get into it can not grow and multiply rapidly. Storing the cream in a clean, light, airy place will also help to prevent their growth, besides preventing contamination by bad odors.

In the best present day creamery practice the butter is usually made from sour cream; but the cream must reach the butter-maker in a sweet and clean condition and be soured (ripened) by pure cultures of desirable species of bacteria under controlled conditions, if good butter is expected. Butter made from cream allowed to sour of its own accord, especially if the cream has been produced and handled carelessly, will very seldom be of satisfactory quality.

CONDITIONS AFFECTING THE QUALITY OF CREAM

THE COW AND HER SURROUNDINGS

The condition of the barn and yard where the cows are kept and the milking done exerts a very decided influence on the quality of the cream produced. The walls and ceiling of the cow stable should be as free from dust, dirt and cob-webs as possible. A tight, reasonably smooth floor, with a gutter suitably located for catching excreta as they fall from the cows should be provided, and cleaned at least twice daily during the season when the cows are kept in the stables. Cement has come to be regarded as one of the cheapest, as well as the best and most durable material for stable floors. The stable should be provided with plenty of windows, which enable the dirt to be seen and thus increase the chances for its removal. They cost very little more than the blank wall and, when once installed, the sunlight and pure air they admit cost nothing and are the best purifying agents known.

Cows should never be compelled to wade knee deep in mud and manure while going into and out of the barn or when turned out for exercise or water. A few loads of cinders or gravel or a few tile properly placed will usually prevent this condition. The cows themselves should also be kept reasonably well bedded and clean. This will involve a little extra labor in the winter season, but other farm operations are not usually pressing at this time of the year; besides, a cow that is worth keeping at all will fully repay in increased production any reasonable amount of care of this kind taken to make her comfortable. Clipping the hair closely on the flanks, thighs, and udders of cows will greatly reduce the amount of labor necessary to keep them clean.

Milking should never be done just after handling hay or bedding or when the stable is full of dust or bad odors from any cause, for dust is one of the most common sources of the bacteria and similar organisms found in milk, and bad odors may readily be absorbed by the milk. Milking should be done only with clean, dry hands or machine. Milking with wet hands is filthy. The clothing of the milkers should be of washable material, such as overall cloth, and kept as clean as possible. It is desirable that suits worn for milking should be reserved for that purpose exclusively. The milk should be removed from the stable to a clean, airy place, such as a dairy house which is free from dust, flies and bad odors, as soon as possible after it is drawn. Milk should never be used within five days after calving, nor from a sick cow nor one with a diseased udder.

DAIRY HOUSE

In every case where a considerable portion of the farm income is derived from the sale of dairy products, a building should be provided to be devoted exclusively to their care. Suggestive plans for an inexpensive building of this kind are given, together with plans for the construction and arrangement of its equipment. Variations of these plans to meet individual requirements will readily suggest themselves. The essential features which should be retained in any plan are: A room just large enough (not too large) for the actual needs; a floor, wall and ceiling which can be easily, quickly and thoroughly cleaned; a good drain to carry away waste water; a suitable method for heating the house in cold weather; plenty of light and ventilation; convenient arrangements for washing, scalding and drying dairy utensils; and a good tank and water supply for cooling the milk or cream. This building or dairy house should be convenient to, but entirely separate from the barn where the milking is done. It should be located on slightly higher ground than the barn and well away from all cattle yards, out-buildings and manure piles, and as convenient as possible to the water supply.

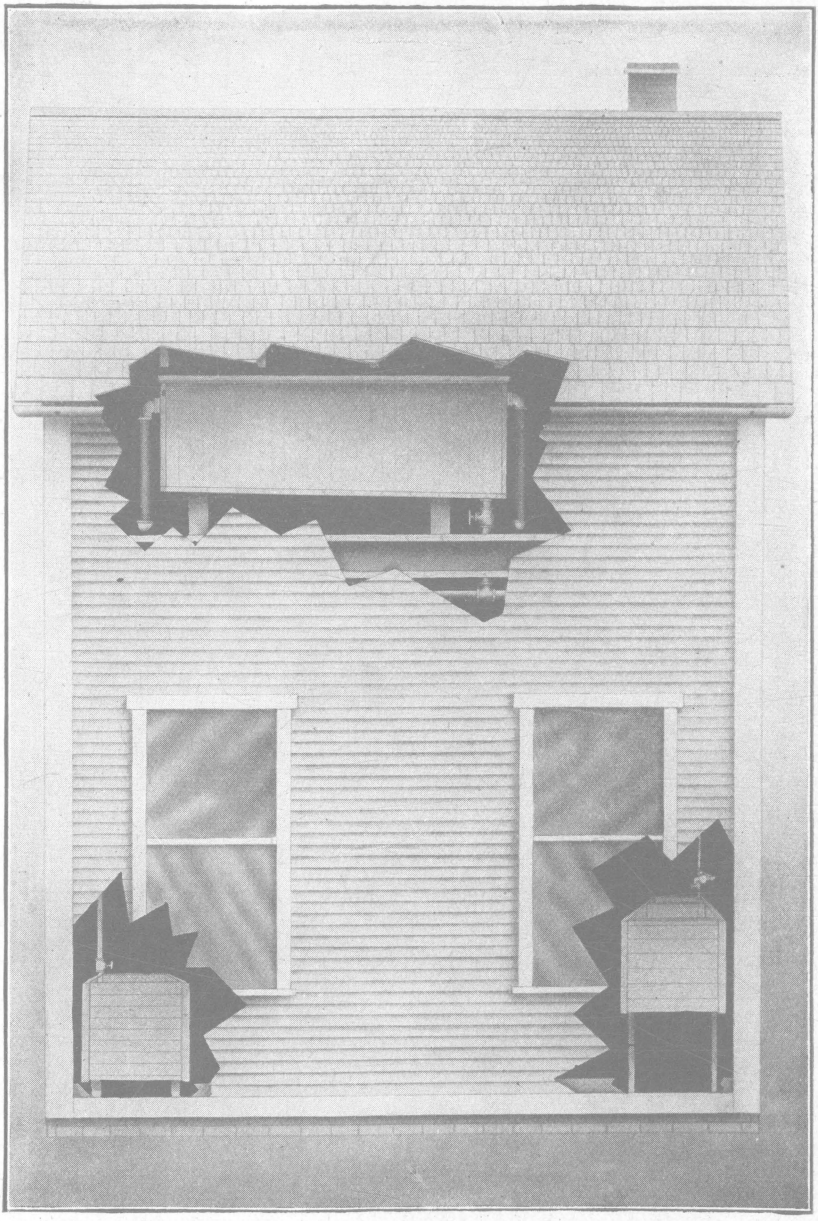

Fig. 1. Showing how a dairy house and an overhead water system may be combined to good advantage under one roof.

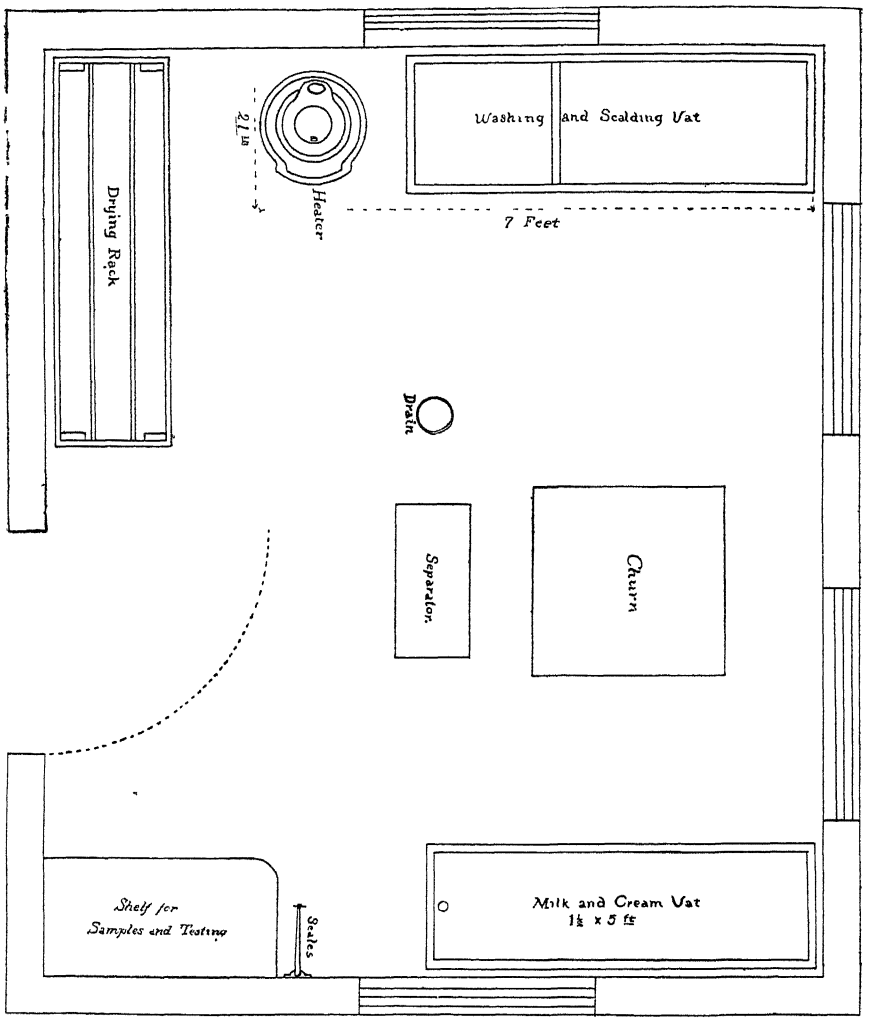

Fig. 2. A satisfactory and convenient floor plan for a small dairy house with a floor space 10x12 feet. A cement floor is to be recommended wherever possible. When cream is sold the churn can of course be omitted. If butter is to be made a small, portab'e table will be needed; also a butter worker, if the churn is not of the combined type. A milk record sheet should be placed on the wall near the scales.

In case a special dairy house cannot be provided, the milk or cream should be handled and stored in a clean, light and well ventilated place, free from strong odors of any kind. A cellar is usually a very poor place for this purpose, especially if also used for storing vegetables.

CARE OF MILK, CREAM AND DAIRY UTENSILS

Where the centrifugal separator is used the milk should be separated while still warm or warmed artifically to 80° or 90° Fahr., if it has unavoidably become cold, in order to avoid a loss of fat in the skimmilk. The cream secured, or the milk itself when the deep-setting system of creaming is employed, should be cooled at once and kept in that condition until delivered. Warm milk or cream should never be mixed with that which is cold or older, since this brings about conditions favorable to the growth of the kinds of bacteria which produce bad flavors. This can be avoided easily by providing two small cream cans in addition to the larger one for storage. One of these should receive the warm cream directly from the separator and be immersed in the cooling water beside the large can until the next milking, when the other small can of warm cream is put into its place and the cream in the first small can poured into the main supply in the storage can.

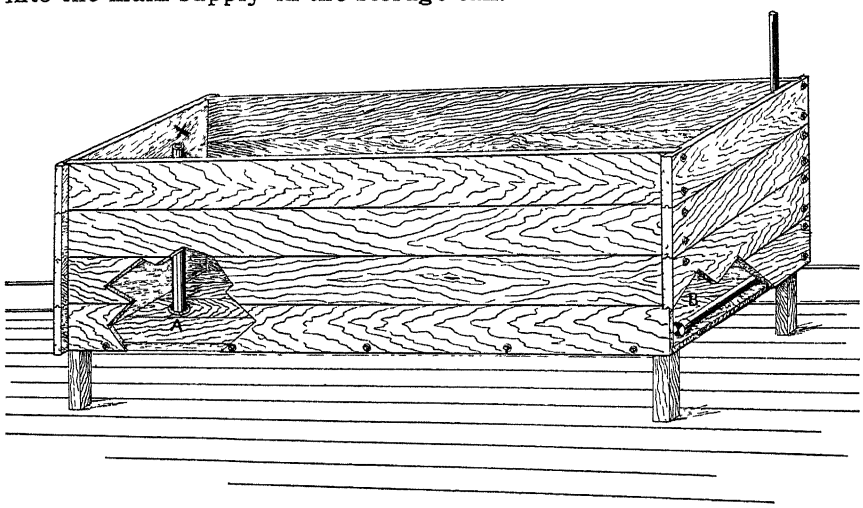

Fig. 3. The arrangement of a suitable cooling vat for milk or cream. To utilize the maximum cooling power of the water this should enter the tank at the bottom (B), and find its exit near the top (X). The hollow plug (X) may be removed when desired for draining or cleaning the vat. If wood is used as a material for this vat, the bottom should be raised a few inches above the floor to prevent rotting. If the floor is of cement the vat can be made of the same material to good advantage. A vat of the size shown in the drawing, 1½x1½x5 feet, will accommodate three ten-gallon cans. For small quantities of cream where economy is essential, a barrel sawed to the proper height and arranged to secure a circulation of water makes a satisfactory substitute for the vat described.

A rack made of narrow strips, with spaces of appropriate size to fit the cream cans used, fastened to the top of the vat will prevent partly filled cans of cream from upsetting.

In case a hand pump is used, this may conveniently be located so that water may be pumped directly into this cooling vat. The pipe leading from the overflow of this vat to the stock watering trough is not shown in the drawings.

In this climate there is no difficulty about keeping the water cold enough during the winter season, but the water should be changed frequently to keep it clean. In the summer, if ice is available and cheap enough, it may be broken and put into the water surrounding the can. Cream will be kept in much better condition in this way than in the average ice box. If ice is not available and the farm livestock are supplied with water from a well or spring near the farm buildings, this water should be run through the vat or barrel in which the cream can stands before going to the trough where the animals are served. The cream cooling vat must at all times be protected from invasion or pollution by these or other animals, and the cream should never be cooled in the tank where the stock drink. The cream can should not be tightly covered for, as explained on page 68, molds and putrefactive bacteria which always produce very bad flavors in the cream find an ideal condition for their development in the dark, moist, closely confined place thus provided. If necessary to cover the cream can this should be done with a loose-fitting cover. A clean piece of white muslin or a piece of wire gauze would be suitable; or a hole may be made just beneath the handle of the regular cover and a piece of gauze soldered in.

TRANSPORTATION

The necessity of keeping the cream cool while on the farm has already been emphasized. The good accomplished by this procedure will be greatly lessened if no way is provided for keeping the cream cool on the way to the creamery. Shipping stations should be provided with arrangements to keep the cream cool until it is shipped. It is usually impracticable to employ ice cooling on the wagons in which cream is delivered to the creamery or shipping station, either by the farmer himself or by the hauler employed by the creamery. Much good can be accomplished, however, by the use of felt jackets for the cream cans. These jackets can be obtained through any store dealing in dairy supplies. They are very efficient either for keeping the cream cool in the summer or for keeping it from freezing in extremely cold winter weather. If special jackets of this kind are not available, a clean blanket or canvas, ethier wet or dry, wrapped about the can will be a great help in keeping the cream in good condition.

It may not be profitable under Ohio conditions to deliver all cream to the creamery daily, as is done in communities producing the very best butter; but the cream should be delivered at least two or three times per week, even in the winter season, if butter of uniform and satisfactory quality is to be expected.

DAIRY UTENSILS

All milk buckets and other utensils used in handling the milk and cream should be of such construction and material that they can easily be kept clean. Many utensils are to be found in use with open or rough seams or joints, as shown in Figure 4. The milk can never be completely removed from these joints by any ordinary method of washing, and it remains there to sour and decay, inoculating each milking with millions of the most undesirable species of bacteria. Utensils made of material having a rough surface should be avoided for the same reason. A good grade of tinware, having joints made smooth with solder, as shown in Figure 5, is probably the best known material for dairy utensils. The milking buckets should not be used for any other purpose. A bucket with a hooded top, as shown in Figure 6, is recommended as being very efficient in keeping dirt out of the milk. No inconvenience will be experienced in using it after the first few times. If dairy utensils are in use having poor and open joints, as described above, the local tinsmith can often correct these faults at a small cost by filling the joints with solder.

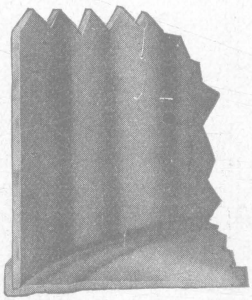

Fig. 4.

A very frequent complaint made by creamerymen is that many farmers do not give proper attention to washing and caring for their milk and cream utensils, more particularly cream separators. Many farmers have been led to believe, by unscrupulous or misinformed separator agents, that their particular make of machine does not need washing except at rare intervals. It is difficult to understand how any intelligent and observing person with any inclinations toward neatness could be made to believe this after having seen the inside of a separator bowl. We are assured, however, that in many cases cream separators are allowed to go for days without being washed. The milk and cream remaining inside the bowl and outlets after a separation are not greatly different from the milk separated except that any dirt which may be present remains in the separator bowl together with a generous share of the bacteria; these multiply very rapidly and inoculate the cream from the next milking with numberless organisms which, even under the best conditions, will taint the cream in a remarkably short time. Cream from a separator cared for in this way cannot be kept in good

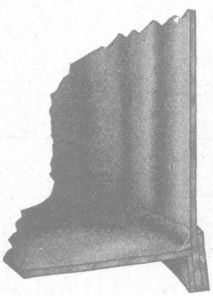

Fig. 5.

condition, no matter how well it may be cared for in other respects. One of the most important considerations in the selection of a cream separator is that it should be so constructed that all parts can be easily and thoroughly cleaned. All parts of the separator coming in contact with the milk or cream must be thoroughly washed and cared for, as described in a following paragraph, after each time the separator is used.

WASHING DAIRY UTENSILS

Brushes are to be preferred to rags for use in washing dairy utensils, because they get into corners and crevices much better. The brushes or rags should be carefully washed and allowed to dry, in the sun if possible, between the times when they are in use. A sour, dirty rag or brush will often leave the utensil in a worse condition than before it was washed, causing the same vile, sour and musty odors to develop in the utensil that were present in the brush or rag.

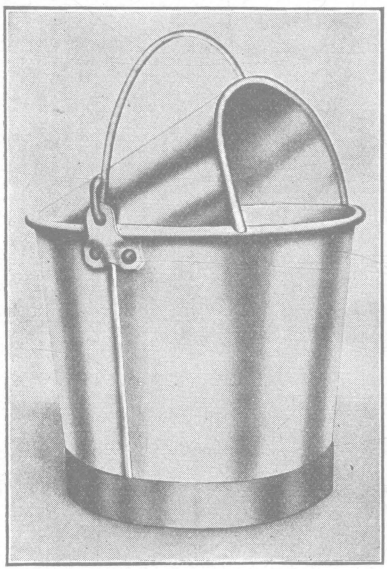

Fig. 6.

All milk or cream utensils should be rinsed first of all with cold or lukewarm water. This step should never be omitted, for hot water introduced directly into milk vessels coagulates the albumin of the milk, forming a sticky layer over the surface which is very difficult to remove. The utensils rinsed as indicated should then be washed thoroughly in hot water containing soap, or better still, Bicarbonate of Soda (ordinary Saleratus or baking soda), cheap grades of which are sold as dairy cleaning powder under various trade names. The soap or soda readily dissolves the layer of fat on the utensils, which is very difficult to remove in any other practicable way. The utensils should then be scalded or steamed and allowed to dry thoroughly without the use of towels of any kind.

SCALDING AND STERILIZING

In some of the modern dairies producing the best grade of market milk complete sterilization of all equipment used in handling the milk is practiced. Such elaborate and expensive systems as are

required for this purpose could not be maintained with profit by the average farmer producing cream for butter-making, and some simpler system, such as described in this publication, which will secure a partial sterilization sufficient for the purposes, is to be recommended.

An article is said to be sterile when all kinds of bacteria and kindred organisms, with their spores (seeds), found about it are completely killed. Sterilization may be effected by heat, by certain kinds of light and by various chemicals; heat and direct sunlight being the only means available for sterilizing dairy utensils. Complete sterilization often requires heating for more than an hour at the boiling temperature of water. If a higher temperature is secured by the aid of steam under pressure less time is required.

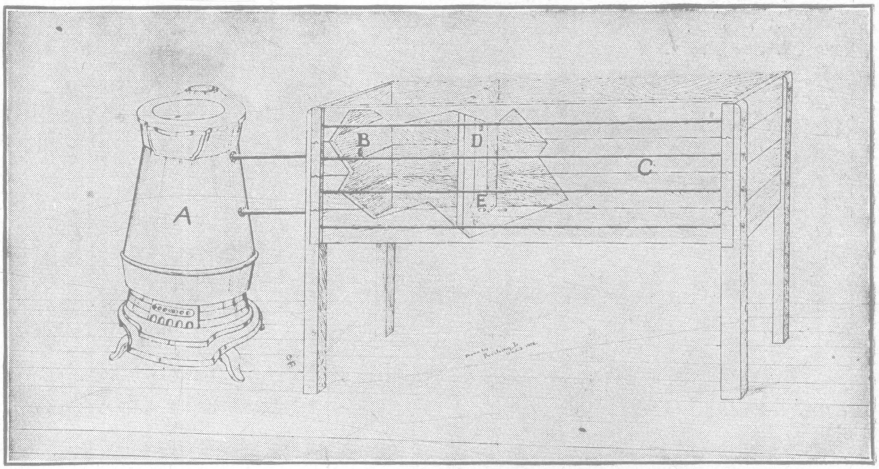

Fig. 7. A suitable and convenient arrangement to be used in washing and scalding dairy equipment:

The stove (A) is made with a hollow water-jacket surrounding the fire box. It will furnish an abundant supply of hot water and also heat for the dairy house in cold weather. A stove of this type, known as a tank heater or laundry stove, should be obtainable at moderate cost through the local dealer in stoves or plumbing supplies.

The following dimensions will make a vat of convenient size: Total length 54 inches, width 20 inches, depth 18 inches, outside measure, supported on legs to secure a total height of 36 inches. The vat is divided by a partition into compartments B and C, approximately 18 and 32 inches in length, respectively. An opening shown at D, closing with a plug, is provided in this partition, permitting hot water to be drawn from the upper part of B into C. An opening, also closing with a plug, for connecting with the drain is provided in each compartment, as shown at E. The drain itself is not shown.

Compartment B may be provided with a tight, hinged cover, having a small opening at its center. Large vessels inverted over this opening, while the water in B is being boiled, will be effectively steamed. Small utensils and separator parts may simply be immersed in the hot water after washing and allowed to remain 15 minuter or more. When removed they will dry readily of their own accord and be practically sterile. This vat and heater can be operated successfully in the absence of any water system other than the ordinary hand pump.

Scalding, then, as it is ordinarily practiced, must not be confused with sterilization. It does serve a very useful purpose, however, for it heats the vessel sufficiently so that it dries rapidly and thoroughly; and although only a small part of the bacteria are killed,

those remaining cannot develop and multiply on the dry surface as they would on the wet surface of an unscalded utensil. If the utensil is not scalded and is put away wet, or if it is scalded and afterwards tightly covered or inverted on a level surface such as a floor or table, shutting out the air and light, some of these organisms find an ideal condition for their development, which takes place with the production of the vile odors typical of their growth. This is easily demonstrated as follows: Wash two milk cans or bottles, scalding them after the usual manner. Allow one of them to remain open and exposed to the light and air, and close the other tightly with a cover, or invert it on a smooth floor or table. After a few hours note the condition of each as to odor. Now cover the dry one as the other was covered and allow to stand for the same length of time, again noting the condition. Cream or milk placed in cans which have been cared for in this way will develop the same kind of flavors. After being washed and scalded as thoroughly as possible, utensils of this kind should be placed in such a position that they will drain well, but at the same time be open to the air and light. This may be accomplished by inverting them on a rack such as is shown in Figure 8. It is the best of practice to allow this rack to stand out of doors in the sun, provided birds and poultry are not allowed to resort to it.

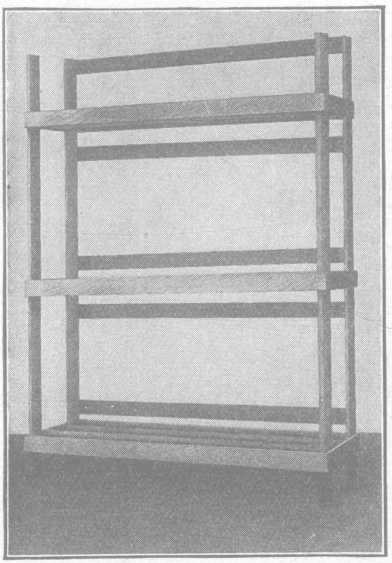

Fig. 8.

ELABORATE EQUIPMENT IS NOT ESSENTIAL TO THE PRODUCTION OF GOOD CREAM

Under present Ohio conditions the production of cream for butter making is little more than a side issue to a type of general farming or to the family milk supply. For this reason it would usually not be profitable to carry out such elaborate precautions to prevent contamination of the milk or cream or to provide such elaborate equipment for this purpose as is demanded for the production of the best grades of market milk. Fortunately this is not essential. The general adoption of some such simple course of

procedure as the one which has just been indicated would result in a very marked improvement in the quality of Ohio butter, accompanied by increased returns to Ohio farmers, and increased satisfaction with, and demand for the product of Ohio creameries. It is not intended that any advice contained in this circular should lead to the discarding of good equipment and its immediate replacement by new and expensive devices. In the production of good milk and cream, care and thoughtfulness are usually more effective than elaborate equipment. No advantage whatever is usually gained by the use of patent strainers, aerators, etc. It should be noted that all apparatus and equipment here recommended is of the simplest and most serviceable type. Whenever it is necessary to replace worn out equipment, remodel old buildings or provide new ones, the improvement should be planned to conform essentially to the recommendations made herein.

CREAM GRADING

In the absence of any sytem of payment based on quality of cream, the painstaking farmer receives no more for his good product than his slovenly neighbor does for his poor one. This is but a survival of the antiquated and unjust system practiced by local butter buyers at the country stores before the advent of the creamery, who paid a uniform price for all butter regardless of its quality; although they realized a handsome profit on the best butter, but suffered an almost total loss on the poorest. The most progressive creameries the country over are adopting systems of paying for cream on the basis of quality. This is the only just system and the only one which will tend to permanently improve the quality of Ohio butter. In such creameries the cream is usually divided into three grades, and a difference in price of 5 cents per pound for fat is maintained between the best and poorest grades. Concerted action on the part of the farmers in any given locality would probably secure the adoption of such a system by the creamery handling their product. Many creameries which have not yet reached the stage of dividing profits with the patrons producing the good cream and dividing losses with the ones producing the sour, stale cream, protect themselves by grading the cream for their own purpose, realizing that part good butter and part poor butter is more to their advantage than a product entirely poor.

It has been shown in the preceding pages that "it pays" to produce good cream rather than poor cream. There is still another reason for doing this, which must not be overlooked. All cream or the butter to be made from it is ultimately intended for use as human

food. From this standpoint, it is entitled to the same degree of care and consideration which the careful housewife gives to the preparation of other food for her family table.

There are numerous questions regarding different phases of cream production which the Station is frequently called upon to answer by letter, showing that there is a lack of general and clear understanding regarding them. Certain of these questions are of more or less general interest and will be briefly discussed in the following pages.

CREAM TESTS

FACTORS INFLUENCING THE PERCENT OF FAT IN CREAM

It is well known to most users of cream separators that a slight adjustment of the cream screw will make a very decided difference in the richness of the cream separated. The experiment stations of two states, working independently, have recently called attention to the fact that several other conditions also have an important influence in determining the richness of the cream. These other factors are: Speed of the separator; richness of the milk separated; rate at which the milk flows into the machine; depth of milk in the supply tank; temperature at which the milk is separated; and the amount of water or skimmilk used to flush the bowl of the separator.

Unless unusual precautions are taken to keep all these conditions constant, any one or more of them may vary decidedly at different times of separation. Some of these are quite beyond control under ordinary conditions. Weather and seasonal changes will greatly affect the temperature of the milk at the time of separation. Sudden changes of food and surroundings, and the advancing lactation period of the cows, as well as weather and seasonal changes, may affect the richness of the milk. The operation of the separator by different persons, or by only one person without absolutely uniform methods, will change others of these conditions. The total fat content of the cream separated is not usually much affected by ordinary changes of this kind. The lowering of the percent of fat in the cream is simply a result of allowing more skimmilk to remain in it, thus lowering the test, but increasing the weight. Failure to take into account these lesser but ever present causes of variation in cream richness leads to much misunderstanding between farmer and creameryman regarding the accuracy or honesty of cream tests. The farmer cannot understand why his cream test varies when he is milking the same cows, fed and cared for in about the same way, and has not changed the adjustment of his separator.

UNFAIR WEIGHTS AND TESTS OF CREAM

The farmer producing cream is entitled at all times to know definitely that the weights and tests given him are fair. If he has occasion to suspect that he is not receiving fair treatment he should be in a position to satisfy himself regarding these points. It sometimes happens that careless and incompetent persons are entrusted with the operation of the Babcock test. When this condition prevails the farmer may at times receive a higher, at other times a lower test than the correct one. Butter makers unable to get as big an over-run or churn gain as that expected by the creamery officials have been known to under-read tests in order to cover up this failure and thus maintain their standing with their employers. Greedy and short-sighted creamery operators have been known to systematically cut down the tests of all the cream they bought. For all such practices, if detected, there is provided by law penalty of both fine and imprisonment. As shown on page 73, the practice of measuring instead of weighing cream samples may also result in unjust tests to the farmer. In some states it is also an express violation of the law to use tests made in this way as a basis for cream payments. Careless sampling is probably responsible for more unfair tests of cream than all other causes combined; and whenever doubt regarding the accuracy of tests is entertained, the first place to look for trouble is in the sampling of the cream at the farm or shipping station. If cream is allowed to stand, the greater part of the fat rises to the surface in the same manner as the cream itself rises to the surface of milk when the latter is allowed to stand. The cream at the surface of a can may test 50 to 60 percent fat, while that at the very bottom of the can may be little richer in fat than skimmilk. Before an accurate sample of such cream can be secured it must be thoroughly mixed, as will be presently described.

WEIGHING AND SAMPLING CREAM

Inquiry into the accuracy of the weights which are being received is a very simple matter. The weight of the full can, less the weight of the unwashed, empty can, both taken on the same pair of scales, will give the weight of cream taken, provided the scales are sensitive and accurate; this point should be carefully determined by comparison with other scales known to be accurate before the cream buyer is accused of dishonesty regarding weights. Stirring alone, even when carefully done, is not usually sufficient to secure a thorough mixture of cream. This is best accomplished by pouring the cream two or three times from one container to another. Sour cream and very cold cream are especially difficult to mix.

Samples for testing should be removed at once after mixing, and no sample for testing should be taken until the sample has been thoroughly mixed as described. If the weighing and sampling is properly done the trouble must be sought elsewhere. The farmer should secure and test an accurate sample of his own cream. The sample tested should represent exactly the same period as that tested by the creamery, rather than a single separation, in order that the results may be entirely comparable. If each shipment of cream is tested separately, two or three ounces of the cream, mixed as described above, should be removed to a tightly covered jar or stoppered bottle and tested as soon as convenient. If the tests at the creamery are made on composite samples the farmer should also prepare a composite sample covering exactly the same period as the sample tested by the creamery. The jar or bottle in which the sample is prepared should contain a suitable preservative to prevent souring of the cream, as described for composite samples of milk in Circular 122 of this Station. A definite amount of the carefully mixed cream for each unit delivered, say one teaspoonful per pound or two tablespoonfuls per gallon, should be placed in this sample bottle from each shipment of cream represented in the test reported by the creamery. The jar or bottle must be kept closed to prevent evaporation of moisture. The sample prepared by either of the methods just described should be warmed to blood heat and mixed, very thoroughly but carefully to avoid churning, before it is tested.

If it is evident, from tests conducted as described, that unfair tests are being received, take the matter up candidly with the representative of the company and endeavor to secure adjustment in this way. If neither party is satisfied regarding the reliability of the tests made by the other, several lots of cream should be sampled and sealed in the presence of a representative of each party and the samples submitted for testing to a third disinterested party, known to be skilled in the operation of the Babcock test. If satisfaction cannot be secured in any of these ways, or if the adjustment is only temporary, the case should be referred to the State Dairy and Food Commissioner at Columbus, Ohio, who is empowered by law to collect evidence in, and prosecute such cases.

In sending a sample of cream away to be tested a 2-ounce, cork-stoppered bottle is the best container. The bottle should be completely filled to prevent churning of the cream. The small, screw-top jars in which cream haulers take their samples are not satisfactory for sending samples of milk or cream by mail or express, for a portion of the sample almost invariably leaks out and the portion which remains does not usually give a correct sample of the original cream.

TESTING CREAM

Circular 122, just referred to, gives complete directions for the operation of the Babcock test and a list of the materials required in testing milk. If many samples of cream are to be tested, or if strictly accurate results are demanded on even a few samples, there must also be provided special cream testing bottles and a pair of sensitive balances with suitable weights for weighing 9 and 18-gram samples of cream. Cream varies greatly in specific gravity, depending on its fat content and condition. It also adheres very badly to the sides of the pipette when one attempts to measure it, making it impossible to secure an accurate sample by any method except weighing. Some cream testing bottles are intended to be used with 9-gram samples of cream; others are intended for use with 18-gram samples. Balance the empty bottle in one pan of the scales, then place the desired weight in the opposite pan and pour into the bottle by means of a pipette enough of the carefully mixed sample to just balance again. Rinse the cream from the neck into the bulb of the bottle with warm water, adding enough water to make the bulb slightly more than one-half full 17.5 c. c. of sulphuric acid are then added, and the test finished as described in Circular 122. It is customary to read cream tests from the bottom of the meniscus, or curved upper surface of the fat column, rather than from the top, as is done in the case of milk tests. If the fat column more than fills the graduated space in the neck of the bottle, repeat the test, dividing the sample between two bottles. Fill the bulb of each bottle till one-half full with warm water, add the full amount of acid to each; then finish as usual and add the readings obtained. A test carefully conducted as described above should yield correct results, and there is no reason why a careful farmer with a good hand tester and equipment cannot make a test which is as much to be relied upon as that made at the creamery. Especial care should be exercised, however, to see that the sample is not allowed to become cold during the testing.

MEASURING SAMPLES OF CREAM FOR TESTING

The farmer who merely wants to test a sample of his own cream occasionally to determine approximately whether he is being given a fair test, and feels that he cannot afford to buy a special pair of scales, may secure a test which will probably be sufficiently accurate for his purpose as follows: 17.6 c. c. of the carefully mixed sample are measured into an 18-gram cream test bottle with the regulation milk pipette, the cream adhering to the inside of the pipette being carefully rinsed into the bottle with warm water. About 17.5 c. c. of sulphuric acid are added and the test finished as usual. Tests

obtained in this way will be somewhat lower than the correct test because the sample of cream taken in this way will not weigh 18 grams, which is the correct amount to take for a sample. With a rich cream testing 50 percent butterfat or higher which does not contain air bubbles, the error will probably be between 2 and 3 percent; for cream testing 30 percent butterfat or less, free from air bubbles, the error by this method should be less than one percent. The error will be greater than this on fresh separator cream or cream which has been vigorously stirred or shaken, ("whipped,") on account of air incorporated into the cream. If the rinsing of the pipette is omitted, as would undoubtedly be the practice of any creamery careless enough to employ this method, the error is considerably increased. The use of a special 18 c. c. pipette instead of the 17.6 c. c. pipette has been widely advertised as correcting the errors due to the measurement of cream samples. The use of this special pipette can in no way reduce the errors due to the adhesion of cream to the pipette, nor to the occlusion of air by the cream. With thin cream having a specific gravity greater than 1, the sample measured with this pipette may be too large; while with very thick cream the sample will certainly still be too small. The use of these pipettes is only a crude attempt to lessen one of the errors mentioned above and can never be depended on to deliver the proper amount of cream. Tests made in this way should not be tolerated as a basis for cream payments.

RELATION BETWEEN BUTTERFAT AND BUTTER

To calculate the amount of butterfat from the weight of cream delivered and the test, multiply the two together and divide the product by 100. Thus, 25 pounds of cream testing 39 percent butterfat contains (25x39 divided by 100) 9.75 pounds butterfat.

On page 71 we had occasion to refer to over-run or churn gain. Besides butterfat, butter contains varying amounts of water, salt and curd (milk solids other than fat). Eight pounds of butterfat will ordinarily make from nine and one-half to ten pounds of butter; the exact amount depending on the character of the fat, conditions maintained during the process of manufacture, and the amount of salt added. The amounts named correspond to a churn gain of 18.7 percent and 25 percent respectively.

Formerly the prices paid by many creameries for butterfat and the prices received by them for their product bore a certain definite relation to what was known as the "Elgin Quotation." This quotation was issued by a large board of trade organized for the purpose of dealing in butter, which met weekly at Elgin, Illinois. The

quotation was established by a vote of this body as to what it considered to be the average market price of the grade of butter known as "Creamery Extras." This board has recently undergone a reorganization as a result of Governmental inquiry into its methods and its quotations have lost much in the way of popularity. Quotations based on the prevailing price of butter in the markets of New York, Chicago, or other large cities are often used in the same way.

SELLING THICK OR THIN CREAM

The question often arises whether it is advisable to sell a comparatively low testing cream or one very high in fat content. If cream very rich in fat is separated, more skimmilk is retained on the farm, the cream is somewhat less quickly tainted by fermentation, and less labor and storage space is required to transport a given quantity of butterfat to market than would be the case if a thin cream were produced; while on the other hand, there will be a greater loss of fat in handling, and probably with most separators a greater loss of fat in the skimmilk. There will certainly be a much greater loss from fat adhering to the separator parts and utensils, especially in cold weather, than would be the case if a thinner cream were separated. Taking all these factors into consideration, it is probable that the selling of a cream testing within the range of 30 to 40 percent will combine more advantages and fewer losses than the selling of either a thicker or a thinner cream would do.

RELATIVE ADVANTAGES OF SELLING CREAM AND MAKING BUTTER AT HOME

The question is frequently asked, "Which is the more profitable, making butter at home, or selling cream to the creamery?" So many factors are involved that no one answer can be given to fit all cases. In general it may be said that, when a uniformly fine quality of butter can be produced on the farm, and a ready market at good prices is available, and the making and marketing of the butter affords useful employment for members of the farmer's household, but does not inflict hardship on any of them, the making of butter at home is advisable. If on the other hand, trouble is experienced in making a uniformly good quality of butter, if the butter must be sold at a comparatively low price at the local stores, if extra help must be hired in order to make and market the butter, or if these operations impose an unreasonable burden on any member of the farmer's family, it would be advisable for the farmer to allow the creamery to manufacture and market his product.

METHODS OF SEPARATING CREAM

The use of the centrifugal hand separator is quite general on Ohio farms. There are many farmers, however, who have persuaded themselves that they cannot afford one of these machines; or who for some reason have become prejudiced against them, and continue to use some form of the old gravity system of creaming. The most efficient form of gravity creaming is that in which the undiluted fresh milk is set in deep cans and kept at a temperature near 40° Fahr. for about 24 hours. Under favorable conditions only about two-tenths percent of fat is lost in the skimmilk by this method. If the most favorable conditions are not maintained the loss is much greater, often amounting to more than one percent. The temperature in particular must be kept as low as possible in order to secure good results. A loss of one-half to one and one-half percent of fat in the skimmilk will usually be sustained by allowing the cream to rise either in deep or shallow pans at ordinary temperatures.

The use of the so-called "separators" which depend for their efficiency on the dilution of the fresh milk with water, and allowing the cream to rise as in the deep setting system, offers no advantage whatever, but several disadvantages when compared with other systems of gravity creaming. The percent of fat in the skimmilk is not materially lessened by the addition of the water, but the amount of skimmilk is greatly increased, thereby increasing the total loss of fat. The cream is very thin and is liable to bacterial contamination from the water added. The skimmilk also is less valuable because it is diluted. To obtain even an approximation of satisfactory results by any of these gravity systems ice cooling of the milk must ordinarily be employed. To cool such a large quantity of milk to 40° Fahr. and maintain it at that temperature for 24 hours is entirely too expensive a process to be practiced with profit under most conditions.

Most makes of centrifugal separators working under the conditions prescribed by the manufactures will remove all but 2 to 3 hundredths of one percent of fat from the skimmilk. The argument often advanced by adherents of the old system that the fat present in the gravity skimmilk but removed by the separator is needed as food by the animals receiving the skimmilk is not valid. Butterfat worth $600.00 per ton is entirely too expensive a feed for livestock when other material in the form of grains rich in fat can be successfully substituted at a small fraction of the cost. Even the farmer who keeps but two or three cows of ordinary productive capacity could pay for a good centrifugal separator in from one to two years out of the actual saving such a machine would effect for him.

Regarding the choice of a separator it may be said that poorly designed and cheaply constructed cream separators can seldom be relied upon; they frequently get out of repair, and their period of usefulness is, as a rule, very short. On the other hand, carefully designed and well made machines can always be depended on to give good service. They require very little trouble or expense to maintain them in good condition, and with proper care they will last for many years. Quality rather than price should be first considered in purchasing a cream separator.

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